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10/803,949	03/19/2004	Xinming Wang	2004_0441A	7167

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EXAMINER

BAREFORD, KATHERINE A

ART UNIT	PAPER NUMBER
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1762

DATE MAILED: 11/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/803,949

Applicant(s)

WANG ET AL.

Examiner

Katherine A. Bareford

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,6-19 and 31-34 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Claims 2-5 and 20-30 are canceled

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. The amendment of October 6, 2006 has been received and entered.

With the amendment claims 2-5 and 20-30 are canceled, and claims 1, 6-19 and 31-34 (including new claims 31-34) are present for examination.

Election/Restrictions

2. The Examiner notes that non-elected claims 20-30 have been canceled in the amendment of October 6, 2006.

Specification

3. The substitute specification and abstract filed October 6, 2006 are acceptable.

Claim Objections

4. The objection to claim 10 is withdrawnⁿ as the claim has been made dependent on claim 7 in the amendment of October 6, 2006.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 31-32 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

New claims 31 and 32 claim the use of palladium hydrochloric acid, palladium sulfuric acid and palladium acetic acid (claim 31) and palladium sulfuric acid (claim 32). However, these terms are confusing as worded. The Examiner can find no indication that such compounds exist and the use of such a material does not correspond to the examples (paragraph [0122] of the specification), where the pretreatment liquid is described as a mixed solution of palladium chloride and hydrochloric acid or palladium sulfate and sulfuric acid. It appears that applicant means "palladium in hydrochloric acid", "palladium in sulfuric acid" or "palladium in acetic acid", and the Examiner has examined the claims on this basis.

Claim Rejections - 35 USC § 102

7. The rejection of claims 1-5, 9, 11, 12 and 14-17 under 35 U.S.C. 102(e) as being anticipated by Yoshio et al (US 6555158) is withdrawn due to the amendments of October 6, 2006.

Claim Rejections - 35 USC § 103

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

10. Claims 1, 6-9, 11-13, 17, 19 and 31-34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ferrier et al (US 5843517) in view of Chen et al (US 6699380).

Ferrier teaches a substrate processing method. Column 3, lines 15-35. A substrate is provided having both a metal region and an insulating film on a surface thereof. Column 2, lines 55-65 and column 4, lines 40-55. Ferrier provides a preplating treatment to the surface of the substrate, where pretreatment liquid (activator solution) is brought into contact with the surface of the substrate. Column 3, lines 15-25. This liquid etches the surface from the acid in the liquid (thereby removing a metal oxide film from the surface of the metal region and residue from a surface of the insulating film, which will inherently occur given the "etching" and the amount of acid in the

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solution). Column 3, line 65 through column 4, line 10 and column 4, lines 30-40. At the same time, the liquid also contains catalyst ions that impart a catalyst to the metal region so as to activate the surface of the metal region. Column 3, lines 35-50 and column 4, lines 30-40. Then, pretreatment liquid remaining on the surface is removed in a rinsing treatment. Column 4, lines 20-25. Then an electroless plating process is performed on the surface of the substrate to selectively plate and alloy film on the surface of the metal region. Column 4, lines 20-30, column 3, lines 1-10, and column 5, lines 25-50.

Claim 6: the pretreatment solution can be applied by spraying. Column 4, lines 30-40.

Claim 9: the substrate can be immersed in the pretreatment solution. Column 4, lines 30-40.

Claim 11: the solution is prepared by mixing together catalytic metal ions and an acid for purifying the surface of the substrate (by etching). Column 4, lines 1-20.

Claim 12: the rinsing includes rinsing with water. Column 5, lines 20-25.

Claim 17: a desired temperature of the solution is between 20-40 degrees C. Column 4, lines 30-40. A desired concentration of components is also given. Column 3, line 35 through column 4, line 10.

Claims 31-32: the pretreatment liquid can include an aqueous liquid with palladium in sulfuric acid, which provides a mixture of palladium in sulfuric acid and sulfuric acid (see the 35 USC 112 rejection above). Column 3, lines 35-50, column 3, line

65 through column 4, line 10 and column 5, lines 25-40 (as shown by Example 1, palladium ion in an acid can be mixed with further acid as well).

Claim 33: the replating treatment simultaneously performs the metal oxide film removal (as shown by the etching), residue removal (as shown by the etching) and imparting the catalyst (activation). Column 4, lines 30-40.

Claim 34: the electroless plating is performed after removing the pretreatment liquid. Column 4, lines 20-30.

Ferrier does not teach that (1) the initial substrate is dry (claim 1), (2) that after electroless plating the substrate is post-cleaned and dried (claim 1), (3) spraying solution on a downwards facing substrate and rotating the substrate (claims 6,7), (4) the different flow paths (claim 8), (5) the pure water used (claim 12), (6) the cleaning using aqueous liquid mixed with one component or more of an electroless plating solution (claim 13), (7) maintaining conditions of the pretreatment conditions and electroless plating conditions (claims 17, 19). As to a dry substrate, Ferrier does teach that the process can begin with contacting with the pretreatment activator solution, as the steps 1 and 2 are optional (column 4, lines 15-30).

Chen teaches a substrate processing method that can be used to treat integrated circuits with metal regions. Column 1, lines 15-20. The process includes providing a dry substrate to a processing module. Column 8, lines 5-20. Then, preprocessing occurs. Column 8, lines 10-20. Then, plating, which can be electroless plating, occurs. Column 8, lines 15-25 and column 1, lines 25-30. Finally, post processing, including rinsing,

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cleaning, and drying occurs. Column 8, lines 20-30. Rinsing in the various steps can be done with pure water. Column 5, line 1 and 39. Liquid can be dispensed to the substrate from a nozzle and the substrate can be facing downwardly. Column 5, lines 1-20. The substrate can be rotated during the treatment steps. Column 5, lines 1-20.

Referring to claim 13, the examiner has taken official notice that it is well known in the art of electroless plating to rinse the substrate with a surface active agent, reducing agent, chelating agent, complexing agent, or other component of the electroless plating bath prior to plating the substrate. As applicant has not traversed this statement from the June 9, 2006 Office Action, it is understood to be agreed to.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ferrier to (1) (2) provide that the initial substrate is dry and that after plating the substrate is post-cleaned and dried as suggested by Chen with an expectation of providing a desirable electroless plating process, because Ferrier teaches a pretreatment and electroless plating process for a substrate and Chen teaches that when providing a pretreatment and electroless plating process, it is well known to start with a dry substrate and to post-clean and dry the substrate after plating. It would further have been obvious to (3) modify Ferrier to provide spraying solution and rinsing liquid on a downwards facing substrate and rotating the substrate as suggested by Chen with an expectation of providing a desirable electroless plating process, because Ferrier provides that the pretreatment liquid in the plating process can be applied by spraying and Chen teaches that it is well known in electroless plating to

provide the liquids to a downwards facing substrate and rotating the substrate during treatments. (4) As to the different flow paths of claim 8, while the flow path system of the rinsing and the pretreatment fluid are not disclosed it would have been obvious to one of ordinary skill that the fluid leading into the nozzle from the pretreatment liquid source must flow from a different source than the rinsing fluid as the two fluids are different and must have different sources therefore the flow paths cannot be identical even if some of the same flow paths is used. (5) It would further have been obvious to modify Ferrier to provide pure water rinsing liquid as suggested by Chen with an expectation of providing a desirable electroless plating process, because Ferrier provides rinsing with water and Chen teaches that it is well known in electroless plating processes to provide pure rinsing water. (6) As to the cleaning using aqueous liquid mixed with one or more components of an electroless plating solution, it would have been obvious to modify Ferrier in view of Chen to provide such a cleaning liquid with an expectation of providing a desirable electroless plating process, because it is well known in the art of electroless plating to be desirable to rinse the substrate with a surface active agent, reducing agent, chelating agent, complexing agent, or other component of the electroless plating bath prior to plating the substrate. (7) As to maintaining the conditions of the pretreatment conditions and the electroless plating conditions, Ferrier teaches desirable pretreatment liquid conditions, and it would have been obvious to one of ordinary skill in the art to maintain the conditions within the desired ranges in order to achieve the desired benefits of those ranges. As to the

electroless plating conditions, it would be obvious to one of ordinary skill to keep the temperature, composition and component concentrations in predetermined ranges during the plating process so that the plating proceeds at a uniform rate. It would be obvious to one of ordinary skill to stop the plating process when the thickness of the plated layer reaches its desired thickness.

11. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ferrier in view of Chen as applied to claims 1, 6-9, 11-13, 17, 19 and 31-34 above, and further in view of Stevens et al (US Patent No. 6824612).

Ferrier in view of Chen discloses all of the features of this claim except that the speed that the substrate is rotated at different times during the processing.

However, Stevens discloses that during the activation of a substrate for electroless plating it is desirable to rotate the substrate at relatively low speeds to facilitate even spreading of the activation solution, and after the application of the activating solution the substrate can be rotated at higher speeds in order to remove any excess activating solution (column 6 lines 30-45).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ferrier in view of Chen to use the rotational speeds suggested by Stevens with an expectation that the benefits discussed above will be achieved.

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- ✓ 12. Claims 14-16^{are} rejected under 35 U.S.C. 103(a) as being unpatentable over Ferrier in view of Chen as applied to claims 1, 6-9, 11-13, 17, 19 and 31-34 above, and further in view of Yoshio et al (US Patent No. 6555158).

Ferrier in view of Chen discloses all of the features of these claims except that the pretreatment and plating are performed in an atmosphere having less oxygen than the atmosphere (claims 14, 15) and that a film thickness/property is measured after post-cleaning and drying.

However, Yoshio teaches an electroless plating process that includes pretreatment steps. Column 2, lines 30-45. Yoshio teaches that it is desirable to perform the pretreatment, rinsing and plating while rotating and discharging air pressure, thus lowering the pressure below atmospheric, reducing the amount of oxygen to levels below atmospheric. Figure 10 and column 7, lines 9-48. Yoshio also discloses performing a CMP (chemical mechanical polishing) procedure after the electroless plating, and that this can be done with ease. Column 8, lines 50-55. The only way to know the success of the CMP procedure is to measure the resulting film thickness after the CMP procedure.

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ferrier in view of Chen to discharge air pressure during the process steps as suggested by Yoshio in order to provide desirable treatment because Ferrier in view of Chen provides for treatment while rotating and Yoshio teaches that it is desirable to discharge air pressure while rotating during

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✓ treatment, thus lowering the pressure below atmospheric, reducing the amount of oxygen to levels below atmospheric. It would further have been obvious to modify Ferrier in view of Chen^{to} measure film thickness after plating, post cleaning and drying as suggested by Yoshio in order to provide desirable treatment, because Ferrier in view of Chen provides plating, post cleaning and drying, and Yoshio suggests to further perform CMP procedures on the plated substrate, which would provide measuring the resulting film thickness after the procedure to confirm that the proper thickness and uniformity has been reached.

13. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ferrier in view of Chen as applied to claims 1, 6-9, 11-13, 17, 19 and 31-34 above, and further in view of Arcilesi et al (US Patent No. 4814205).

Ferrier in view of Chen teaches all of the features of the claim except measuring the concentration of an impurity and removing the impurity when it reaches a certain level.

Arcilesi teaches that when using an activator solution it deteriorates over time as the palladium ions precipitate out of the solution (form an impurity). Arcilesi teaches that when this happens the activator can be rejuvenated by addition of a ferric ion which redissolves the palladium (removes the impurity)(column 5 lines 15-30).

Accordingly, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Ferrier in view of Chen to monitor the

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concentration of the palladium ions and to add ferric ions to rejuvenate the solution when the amount of Pd ions got low so as to extend the useful life of the activator solution as suggested by Arcilesi.

Response to Arguments

14. Applicant's arguments with respect to claims 1, 6-19 and 31-34 have been considered but are moot in view of the new ground(s) of rejection.

The Examiner has provided the reference to Ferrier as to the newly claimed features as to the pretreatment liquid.

Conclusion

15. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date


of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:00-3:30) with the First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on (571) 272-1423. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and for After Final communications.

Other inquiries can be directed to the Tech Center 1700 telephone number at (571) 272-1700.

Furthermore, information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


KATHERINE BAREFORD
PRIMARY EXAMINER